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ENTERPRISE ARCHITECTURES VALUE DRIVERS

Luis Silva Rodrigues and Luis Amaral
Department of Information Systems
E-mail: lsr@iscap.ipp.pt

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ABSTRACT

In the past two decades, there has been a considerable interest in Enterprise Architectures both in academia and industry. As evidence of it, an increasing number of organizations have recognized the strategic importance of Enterprise Architectures and significant investments were made. However, the current economic pressures and the need to justify the usefulness and investment on Enterprise Architectures are increasingly demanding an assessment and demonstration of its value. Despite the interest and need it is widely recognized that it still is very difficult for organizations to assess and measure the Enterprise Architecture value. The lack of a clear understanding on what is important for Enterprise Architecture value assessment, the intangible nature of some benefits and the need to quickly demonstrate the Enterprise Architecture value are some of the main reasons for this difficulty. This article presents the results of a Delphi study involving 63 international experts in which these issues were addressed.

BACKGROUND

Since John Zachman published, in 1987, the widely accepted Enterprise Architecture Framework (Zachman 1987), there has been a growing interest and development in Enterprise Architectures. The importance given to the subject resulted in a significant number of initiatives, either at corporate or governmental level, which resulted in different approaches, frameworks, methods, models and languages for building and maintaining an Enterprise Architecture.

Despite the significant level development in terms of the approaches, frameworks and methods used, there is still no consensus about what is an Enterprise Architecture. Basically, two approaches to Enterprise Architecture definition can be noticed, one sees it as a descriptive concept that factually describes the characteristics of existing artifacts, whereas the other sees it as a prescriptive concept that defines how artifacts should be realized (Hoogervorst, 2004). Commonly this two approaches are also named respectively the 'as-is' and the 'to-be' state. In our view, an Enterprise Architecture must combine this two approaches and therefore it can be defined as a formal description of an organization that provides an overview of the organizational structure, business processes, information systems and technology infrastructure, through a coherent and comprehensive collection of principles, methods, models, diagrams and other documents that describe the organization and provides a guidance to its evolution, considering the perspectives of different stakeholders. Obviously, associated with it there must be a continuous, iterative and long-term process in the organization that allows its construction, maintenance and governance over the time.

One of the main objectives of an Enterprise Architecture is helping the managers to think the organization as a whole, as it captures and stores in one repository a variety of interconnected information, and helps to get answers to three important issues for organizations: which are the fundamental processes of the organization, how does the IT support these processes, and how are the organizational resources organized and managed.

As the construction, maintenance and governance of the Enterprise Architectures matures into an established function in a significant number of organizations, senior management and Enterprise Architecture managers are increasingly being challenged to present objective evidence of its contribution to the organization. Like any organizational initiative, it is needed time, money, and effort to design, initiate and embed an Enterprise Architecture within the organization. Therefore, given the substantial investment that it represents and the need of current organizations to save resources and prioritize investments, it is perfectly understandable that they want

to know if there is an effective and appropriate return from their Enterprise Architecture.

In a 2007 study of Infosys, about 57% of organizations surveyed reported that they were failing to justify the Enterprise Architectures investments because they couldn't realize its value, considering it too technical (Infosys, 2007). More recently, Gartner stated that about 55% of the Enterprise Architecture projects would be stopped due not only to current economic pressures but also because of the lack of perceived value (James *et al.*, 2008). Despite the growing interest and need for an assessment and measurement of the Enterprise Architectures value, it is recognized that this is still a very difficult and complex task for organizations. Three of main issues or problems that can be appointed for this are the lack of a clear understanding on what is important for Enterprise Architecture value assessment; the intangible nature of some benefits; and the need to quickly demonstrate the Enterprise Architecture value (Rodrigues e Amaral 2011).

It is widely claimed that an Enterprise Architecture can help organizations in many ways and in many areas. In scientific and technical literature we can easily find reference to a large number of benefits of Enterprise Architectures. However, the description of these benefits is not always clear and they are not always perceived in the same way by different stakeholders, making it too complex to identify all of them. In fact, the effort to identify all benefits of Enterprise Architectures can be tremendous and virtually impossible to do it. On the other hand, the benefits of Enterprise Architectures, often classified as Business-benefits or as IT-benefits, can result from a direct or indirect impact of the Enterprise Architecture on different areas of the organization. One of the biggest challenges is to demonstrate a cause and effect relationship between actions within the Enterprise Architecture and the organization improvements. This helps to make it very difficult to determine how the benefits of Enterprise Architectures are achieved and justifies why some of them are often considered intangible in nature and therefore considered very hard to measure and quantify. Finally, the need to quickly demonstrate the Enterprise Architecture value requires that the benefits can be achieved in the short term. Yet, it is important to note that an Enterprise Architecture program is usually a long term project, whose benefits are distributed over time. Know what are the short term benefits is an important aspect in order to quickly convince the stakeholders that Enterprise Architecture has merit, however, if the long term benefits are ignored this could lead to an incorrect value assessment.

Mainly, the assessment of Enterprise Architectures value requires the implementation of a measurement system that gathers the complex information about the use and impact of Enterprise Architecture. But before implementing this measurement system is necessary to clearly understand and know what is important to measure.

In management field, one of the most important and recognized concepts in Value Analysis is the concept of value driver. In this context, value driver is any variable (action) that affects the business performance of the organization in the short or long term and therefore creates value (Koller et al., 2005). This value drivers to be useful the value drivers usually need to be organized and a hierarchy must be established taking into account their impact on value created.

Applying this concept in Enterprise Architectures, an Enterprise Architecture value driver is any variable that affect the value of Enterprise Architecture to the organization. These variables can be characteristics or actions (activities) in the organization that are affected by an Enterprise Architecture program and on a short or long term basis influence the performance of the organization (and creates value). In Enterprise Architecture literature the value driver concept is not a concept commonly used. Yet many of the factors mentioned in the literature as benefits, objectives, motivations, outcomes, or metrics of Enterprise Architectures fit in our view in this concept of value driver. Therefore, given the lack of empirical studies that clearly identify and systematize the value drivers of Enterprise Architecture we considered to be of great interest and importance to develop such study.

PURPOSE OF THE STUDY

As mentioned it is still very difficult for organizations to assess the value of Enterprise Architectures. Despite the importance of the subject, one of the main difficulties for organizations is to know what is important to measure. In this study we intended to identify, systemize and prioritize the responses of some key Enterprise

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Architecture stakeholders to the following main research question:

> *R1: What are the key value drivers of Enterprise Architectures for organizations and what is their ranking of importance?*

Additionally, in order to obtain a better characterization of each value driver two additional questions were formulated:

> *R2: Which value drivers of Enterprise Architectures can be realized in short term (less than a year).*

> *R3: Which value drivers of Enterprise Architectures are of tangible nature?*

The answers to these two questions will allow based on experts experience and knowledge to get a better understanding on which value drivers can be used to justify the importance of Enterprise Architectures in short term and which value drivers are of tangible nature and therefore can be more easily measured.

RESEARCH DESIGN

This research incorporated a web-based modified Delphi survey based on an initial value drivers list generated from a literature review.

The primary purpose of choosing the Delphi method was to obtain a consensus of opinion from a panel of experts on what are the key value drivers of Enterprise Architectures. Another reason was to use the Delphi as a function of the validity and quality of the initial list selection process (Scott et al 2006) used in this study. In other hand, the Delphi method is being used in situations where vague, unknown or contradictory opinions exist, while limited scientific evidence to guide evidence-based decision-making exists (Plessis and Human 2007), which can be applied in this case.

Finally, the Delphi method was chosen because it is considered an appropriate method for collecting data that result from subjective judgments (Linstone and Turoff 1975) and allowed the participation of a group of international experts that would be impossible to contact personally.

The Delphi Method

In Information Systems research, the Delphi method has been quite popular as it can be proven by its use in several studies, especially in studies involving the identification and ranking a set of items (e.g., statements, issues, factors) on a specific topic. However, this is just one of the many applications given to a method originally developed at the RAND Corporation (USA) in the 1950s as a mean to handle opinions rather than objective facts (Schmidt 1997).

Since its development, the Delphi method has been applied in its “classic" or "modified” versions (Powell 2003; Okoli and Pawlowski 2004) in a variety of disciplines (e.g., defense, health, education, information systems), and has become widely used as a tool for measuring and aiding forecasting and decision making (Rowe and Wright, 1999).

The Delphi method may be characterized as a method for structuring a group communication process so that the process is effective in allowing a group of individuals, as a whole, to deal with a complex problem (Linstone and Turoff 1975). Critical to this communication process are four factors: the feedback of individual contributions of information and knowledge; an assessment of the group judgment or view; the opportunity for individuals to revise their views; and some degree of anonymity for the individual responses. The aim of employing the Delphi method is to achieve consensus through a structured and iterative process of listing, refining and aggregating the opinions and perceptions of a group of people, called the expert panel, that could make valuable contributions to the resolution or understanding of a complex topic or problem in order to create a consensual shared vision on the matter under discussion (Soares and Amaral 2011).

The Delphi process typically involves the sending of a series of questionnaires through several rounds (usually 3 or 4 rounds). The number of rounds depends on the type of questionnaire used in the first round and the stopping criteria established by researchers, which include an agreed level consensus and/or a maximum number of rounds. In a classic Delphi the questionnaire used in the first round is usually an open questionnaire that allows participants to freely express their opinions and suggestions. However, this can lead to a very large number of items and make the questionnaire of the

following rounds too large (Keeney et al. 2001) and more complex to answer. To simplify this, it is often used a "modified" Delphi version in which is included in the questionnaire of the first round a predefined list of items. In addition, the use of an initial list of items reduces in one round the number of rounds to be held. At the end of each round of a Delphi study individual responses of experts are gathered and consolidated; and then used to re-design the questionnaire to be used in the following rounds and sent to the participants as feedback.

Expert Panel Selection

The selection of the expert panel is commonly seen as an vital aspect that potentially determines the success and confidence on a Delphi study results (Powell 2003). However, there seems to be some ambiguity regarding the term "expert" as used in relation to the Delphi method as it is argued that there are no universal measures to identify these "experts" (Plessis and Human 2007).

Delphi panelists are typically selected, not for demographic or statistical representativeness, but for the perceived expertise that they can contribute to the topic. In order to obtain the desired valid results, Scheele (1975) suggested that the panel must be selected from stakeholders who will be directly affected, experts with relevant experience, and facilitators in the field under study. Taking this into consideration, we decided to invite to the expert panel three key types of Enterprise Architecture stakeholders, namely Enterprise Architects, Enterprise Architecture program/project leaders and Senior Managers. Because it was considered important to include also the academic perspective, in addition we decided to invite academy members with experience in Enterprise Architecture research. Using an approach similar to that taken by Okoli and Pawlowski (2004) and Soares and Amaral (2011) the process of selecting the experts included the following steps: (1) Define inclusion criteria; (2) Define key searching niches; (3) Populate niches with names; (4) Invite experts and request indication of new experts; and (5) Invite new experts. In this process 166 experts were identified and contacted via e-mail requesting voluntary participation in the study (of which 144 were identified by researchers and 22 suggested by the invited experts).

From the 166 experts invited, 75 (45%) accepted to participate in the Delphi study, but only 63 (40%) actually participated at least in one of the three rounds carried out in this study. The 63 participants were from 17 different countries: South Africa (4), Australia (4), Brazil (2), Canada (1), South Korea (1), Denmark (3), Slovenia (1), United States (9), France (1), Netherlands (5), Ireland (1), Japan (1), Portugal (18), United Kingdom (3), Singapore (2), Sweden (2) and Switzerland (5). In terms of professional background, 42 participants reported that they had an IT background (67%), 11 a Management background (17%), 6 reported a both IT and Management background (10%) and 4 indicated other areas (6%). In terms of experience in positions, 33 participants referred that they already had experience as Enterprise Architect, 19 as Enterprise Architecture project leader/manager, 14 as senior manager and 38 as Enterprise Architecture researchers.

Structure of the Questionnaire

Given the fact that the main research question (*R1*) was the only question on which was intended to reach a consensus among the participants, it was decided that only this question would be asked in all study rounds. The other two questions (*R2* and *R3*) were asked only in the last round of the Delphi survey. Consequently, the questionnaire was divided in two parts: a main part (presented in all rounds) where the experts were asked about the importance that they give to each value driver and a second part (presented only in the last round) where the experts according to their experience and knowledge had to specify which value drivers could be realized in the short term and which drivers they consider to be of intangible nature.

To assess the level of importance assigned to each value driver was used the Q-Sort Method, a ranking technique in which the respondents are required to sort the items supplied (e.g., statements, issues, factors) so that they fall into a predefined matrix, here called Q-Sort Matrix. One of the advantages of using the Q-Sort Method is that instead of assigning a rating to each individual item (using Likert scales), participants have to look at all items as a whole and separate them in several groups in a Q-Sort matrix (Figure 1), ranking from the less important items to the most important items. This procedure makes the respondents to attribute different importance levels to each of the items, avoiding the

concentration of responses in a given value of a Likert scale.

In order to provide in the questionnaire of the first round a list of items (value drivers) as complete as possible it was carried out an extensive literature review in which several journal and conference articles, technical reports, projects reports, research reports, white papers, were examined. From this literature review emerged an initial list of 26 value drivers presented in Table 1 (in Appendix A can be found the complete list of value drivers and their short definition/descriptions used in this study).

Figure 1: Q-Sort Matrix example for 14 items

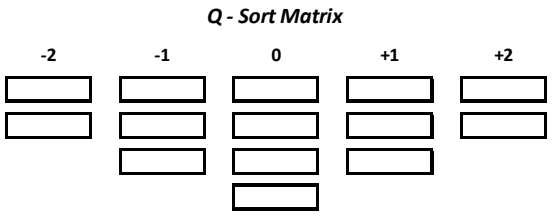

Table 1: Value Drivers Initial List

(Increased) Agility
(Improved) Alignment
(Improved) Change Management
(Improved) Communication
(Reduced) Complexity
(Increased) Compliance
(Reduced) Costs
(Improved) Customer Orientation
(Improved) Decision Making
(Increased) Flexibility
(Improved) Governance
(Fostered) Innovation
(Improved) Interoperability
(Improved) IT Delivery
(Improved) IT Integration
(Improved) Knowledge & Understanding
(Increased) Management Satisfaction
(Facilitated) Outsourcing
(Improved) Planning
(Improved) Portfolio Management
(Increased) Process Improvement & Standardization
(Improved) Quality
(Increased) Reuse
(Improved) Risk Management
(Improved) Security Management
(Improved) Time to Market

Stopping Criterion

Knowing when to stop the process is another important issue when implementing a Delphi study. If the process is finished too early (i.e., with a few rounds) the results may not be significant; and if the process has too many rounds the task may be too heavy (in terms of time and resources) to the participants and, consequently, contribute to the increase of withdrawals.

Ideally, a Delphi study should end when a consensus is reached and preferably validated by a set of statistical indicators to support the results obtained (Schmidt 1997). The recommendation of the method is that at the end of each round the level of consensus should be evaluated and based on it make a decision: to proceed to a new iteration (round) if the level of consensus is not significant; or to end the study if the level is considered appropriate (Soares and Amaral 2011). However, not always the desired level of consensus can be achieved and therefore a Delphi study may end when the researcher believes that sufficient information has been gathered or when a predefined maximum number of rounds are reached. Aware of this situations, before starting the study we established three stopping criteria for the Delphi process, namely (1) the level of agreement of the experts' opinion in the round, (2) the level of stability of the global panel opinion between rounds and (3) a maximum number of rounds to be held.

To evaluate the two first criteria two statistical measures were selected: to evaluate the level of agreement of the experts' opinion in the round was selected the Kendall's W coefficient in which a W>0.50 indicates a good consensus between the responses in the round and a W>0.7 a very good result (Schmidt 1997); to evaluate the level of stability of the global opinion between rounds was selected the Spearman's Rank correlation coefficient (Spearman's Rho) in which a value of Rho close to 1 represents a very satisfactory correlation between two ranks. Regarding the number of rounds, was decided that it would be held three rounds at the most.

DELPHI STUDY EXECUTION

The completion of the three rounds of this Delphi study took 72 days between May 9 and July 20, 2011. The first two rounds were open for completion for 15 days and

the third round was open for 17 days; the time periods between rounds were 15 days.

Round 1

The Round 1 started on May 9 and ended on May 23, 2011. In this round, all the experts had to perform three steps: (1) filling out a form of characterization of the expert, which allowed a better characterization of participants; (2) complete the main questionnaire with the Q-Sort matrix; and (3), optionally, propose new value drivers that in their opinion should be added to the items list. Of the 75 experts who agreed to participate, 57 responded to the questionnaire, representing a response rate of 76%. After reviewing the inputs, we consolidated them into an overall rank of the round which summarized the overall opinion of the 57 participants. In addition, we also analyzed the 31 suggestions for new items proposed by 17 experts. During the review process it was necessary to contact some experts by email in order to complete the information provided or to clarify the meaning of some of the proposals. At the end of the review process 3 new items were accepted and added to the value drivers list (see Table 2) and the results were communicated to the 17 experts that made the suggestions.

Table 2: Round 1 new value drivers

(Enhanced) Assurance
(Enhanced) Enterprise Integration & Consolidation
(Enhanced) Technological Evolvability

The analysis of results ended with an evaluation of the level of consensus achieved in this round through the assessment of the level of agreement between the experts using the Kendall's W. The Kendall's W result was 0.217 ($p < 0.001$) reflecting a weak level of agreement (not satisfactory) between the individual ranks, yet this value is considered normal in the first round. Since this was the first round, it was unnecessary to evaluate the level of stability of opinion between rounds.

Round 2

The Round 2 took place between June 7 and June 21, 2011 and began by sending to participants the consolidated results of the previous round, i.e. the overall rank of the Round 1 and the new list of 29 items (26 items from the predefined list used in Round 1 and the 3 new items suggested by experts). In this round only 73 experts were contacted (due to the withdrawal of two experts) and 57 (78%) completed the questionnaire (51 participated in Round 1 and 6 were participating for the first time). The experts that have participated in the Round 1 only had to complete the main questionnaire, while those who were participating for the first time had to complete the three steps mentioned for the Round 1. Once again, after reviewing the inputs they were consolidated into an overall rank of the round and the level of consensus was evaluated. Regarding to the level of agreement among experts, in this round the Kendall's W increased slightly ($W=0{,}268$; $p<0{,}001$), still showing a weak level of agreement between the individual ranks. In relation to the level of stability between the ranks of Round 1 and Round 2, the Spearman's rho correlation coefficient ($Rho=0.973$; $p<0.001$) showed a very good correlation between the two ranks, demonstrating no significant changes in the positioning of items in the importance rank. Although the level of stability was quite satisfactory in order to seek an improvement on the level of agreement among the experts, we decided to advance to the third and final round (according to the Delphi stop criteria).

Round 3

The Round 3 started on July 4 and ended on July 20, 2011. As it was intended to achieve a higher level of consensus among participants, we decided to involve in this round only the experts that have taken part in one of the two previous rounds. Thus, 62 experts (one participant dropped out in second round) were contacted and 52 completed the questionnaire, representing a response rate of 83%. In this round beyond completing the main questionnaire with the Q-sort matrix, all participants had to answer to the two additional questions of this study (research questions *R2* and *R3*), where they had to specify which value drivers in their opinion can be realized in the short term (less than a year) and which value drivers they consider of tangible nature. After the conclusion of the round we proceeded to a consolidation of the final results that may be found in the section "Results & Discussion" of this article. Regarding to the level of consensus reached in this round, once again we noticed an improvement in the level of agreement between the participants, however the value achieved for the Kendall's W ($W = 0.297$; $p<0.001$) was still low. For its part, the level of stability measured by the Spearman's correlation coefficient turned out to be very satisfactory ($Rho=0.974$; $p<0.001$),

denoting a high degree of stability in the ranking of importance of value drivers. Due to the fact that the maximum number of rounds was reached and the some experts have showed some fatigue in this round, we decided to end the Delphi study and initiate a detailed analysis of the results.

RESULTS & DISCUSSION

In this section are presented the preliminary results of the Delphi study.

Value Drivers importance

In Table 3 are presented the consolidated results of the experts' answers to main question of this study on what are the key value drivers of Enterprise Architectures and how they rank them according to its importance for organizations. The table shows the 29 key value drivers (26 of which resulted from an extensive literature review and 3 were identified and proposed by the expert panel) ordered by the degree of importance attributed by the 52 experts that completed the Round 3. To provide a more completed view of how the rank was generated and how it has evolved over the three rounds, Table 3 includes the mean and the standard deviation obtained for each value driver on Round 3 and the position occupied by each of them respectively in Round 1 and Round 2.

Table 3: Key Value Drivers of Enterprise Architectures – Delphi Study Results

Round 3 Rank	Value Drivers	Mean	Standard Deviation	Round 1 Rank	Round 2 Rank
1	(Improved) Alignment	5,10	5,78	1	1
2	(Improved) Decision Making	6,94	6,38	3	2
3	(Improved) Governance	8,15	5,44	4	3
4	(Increased) Agility	9,60	7,03	2	4
5	(Improved) Change Management	10,60	7,61	6	5
6	(Improved) Planning	11,27	8,01	8	6
7	(Improved) Knowledge & Understanding	11,37	6,72	12	9
8	(Enhanced) Enterprise Integration & Consolidation	11,69	6,63	*	8
9	(Reduced) Complexity	12,83	7,95	7	10
10	(Increased) Flexibility	12,85	6,34	10	15
11	(Improved) Communication	13,13	7,90	5	7
12	(Improved) Interoperability	13,83	7,00	14	12
13	(Increased) Process Improvement & Standardization	14,10	7,37	11	13
14	(Increased) Reuse	14,23	7,10	17	16
15	(Improved) Portfolio Management	14,23	7,14	9	11
16	(Reduced) Costs	15,56	7,38	13	14
17	(Improved) Risk Management	16,00	6,41	18	17
18	(Improved) IT Integration	17,19	7,31	15	18
19	(Improved) Quality	17,50	6,46	19	20
20	(Fostered) Innovation	17,60	8,40	20	21
21	(Improved) Customer Orientation	17,98	8,06	16	19
22	(Improved) IT Delivery	18,23	8,14	22	24
23	(Improved) Time to Market	18,48	8,22	23	23
24	(Increased) Compliance	18,60	6,17	21	22
25	(Increased) Management Satisfaction	20,13	7,79	25	28
26	(Enhanced) Assurance	20,23	7,24	*	27
27	(Improved) Security Management	21,79	5,84	24	26
28	(Enhanced) Technological Evolvability	21,81	5,85	*	25
29	(Facilitated) Outsourcing	24,00	6,31	26	29

* These items were only introduced in Round 2 of the study.

Although one of the criteria used to evaluate the level of consensus has not reached a satisfactory value (Kendall's W coefficient was only 0.293 in Round 3), the results showed that the level of stability between the

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Round 2 and Round 3 ranks was very satisfactory, what is supported not only by the value of Spearman's Rho correlation coefficient (Rho = 0.974) but also by the fact that 13 of the 29 items in Round 3 held the same position obtained in Round 2, most notably the 6 value drivers placed in the top six positions: (*Improved) Alignment*, *(Improved) Decision Making*, *(Improved) Governance*, *(Increased) Agility*, (*Improved) Change Management* and *(Improved) Planning*

Since the positioning of the value drivers in the rank is strongly influenced by the opinions of participants and given that this positioning may change with the participation of other experts, in this study we tried to identify possible groupings of value drivers according to their proximity in the rank. For this we used the multivariate analysis technique Cluster Analysis that seeks to organize information about variables so that relatively homogeneous groups, or "clusters," can be formed (Anderson 1984).

The Cluster Analysis identified a first cluster/group with the value drivers that were considered by panel members as the most important of all. This first cluster is formed by the first three value drivers of the overall rank: "*(Improved) Alignment*"; "*(Improved) Decision Making*"; and "*(Improved) Governance*". The composition of this cluster highlights the role that Enterprise Architectures could have helping organizations to improve the organizational alignment in which assumes particular relevance the alignment between business and IT; and helping to improve two important management activities, namely the decision making processes (at all levels of organizations) and the corporate governance (which includes IT governance).

In a second cluster, the Cluster Analysis includes the value drivers between positions four and eight in the ranking: "*(Increased) Agility*"; "*(Improved) Change Management*"; *"(Improved) Planning*"; "*(Improved) Knowledge & Understanding*"; and "*(Enhanced) Enterprise Integration & Consolidation*". At the opposite extreme of the ranking regarding to less important items, the Cluster Analysis shows a close proximity between the last 5 value drivers, which includes two of the three value drivers proposed by the experts. These 5 less important value drivers are *"(Increased) Management Satisfaction*", "*(Enhanced) Assurance*", "*(Improved) Security Management*", "*(Enhanced) Technological Evolvability*" and "*(Facilitated) Outsourcing*".

Short Term and Tangible Value Drivers

In order to better understand and characterize the 29 value drivers identified in this study, the panel members were asked to give their opinion about two important issues related with the value drivers: (1) their possible short term, less than a year, realization (research question *R2*) and (2) their possible tangible nature (research question *R3*). In Table 4 are presented the consolidated results of the expert responses.

Regarding the results obtained for the question about the short-term value drivers, we highlight the fact that only 4 value drivers (of 29) were considered by the majority of experts as value drivers that can be realized in the short term ("*(Improved) Decision Making*", "*(Improved) Governance*", "*(Improved) Knowledge & Understanding*" and "*(Improved) Communication*")) and for 1 value driver ("*(Improved) Planning*") there was a tie between expert opinions. From these results emerges the awareness that most of the value drivers of Enterprise Architectures cannot be realized in short term which somehow justifies why organizations have difficulty in rapidly justify the value of Enterprise Architectures.

Is also important to emphasize that 2 of the 4 value drivers considered by experts as realizable in the short term, "*(Improved) Decision Making*" and "*(Improved) Governance"*, belong to the previously identified cluster with the most important value drivers. This reflects the importance of these value drivers not only in the "total" value assessment of Enterprise Architectures as well its utility to quickly justify their value to organizations.

Regarding the results for the question about the value drivers of tangible nature, the data shows that only 2 value drivers, "*(Increased) Reuse*" and "*(Reduced) Costs*", were considered by the majority of experts as tangible value drivers. This reinforces the understanding that it is very difficult to establish a cause-effect of the impact of an Enterprise Architecture and consequently measure its impact on organization. However, in Table 4 it is possible to observe that for several value drivers a significant number of experts believe that they are of tangible nature. This leaves open the possibility for in the future, through interviews or structured

questionnaires, check with those experts how these value drivers are realized and how they can be measured.

CONCLUSIONS

This paper presented the findings of a Delphi survey which main objective was to investigate, identify and prioritize the key value drivers of Enterprise Architectures for organizations. In this study, the Delphi method proven to be very useful as it made possible to get information from a heterogeneous group of experts and helped to validate and complete a list of key value drivers of Enterprise Architectures to organizations. Given the fact that this study focuses on an area of interest that has not been extensively explored, we believe that we have generated a comprehensive list of 29 key value drivers of Enterprise Architectures that can be considered as a valid contribution to a better comprehension of the important issues to Enterprise Architectures value assessment and provides a solid basis for the future development of a value measuring system for Enterprise Architectures.

Table 4: Short Term & Tangible Value Drivers

Round 3 Rank	Value Drivers	Short Term					Tangible				
		Yes			No		Yes			No	
1	(Improved) Alignment	(37%)	19	-	33	(63%)	(29%)	15	-	37	(71%)
2	(Improved) Decision Making	(63%)	33	-	19	(37%)	(31%)	16	-	36	(69%)
3	(Improved) Governance	(60%)	31	-	21	(40%)	(42%)	22	-	30	(58%)
4	(Increased) Agility	(13%)	7	-	45	(87%)	(19%)	10	-	42	(81%)
5	(Improved) Change Management	(44%)	23	-	29	(56%)	(19%)	10	-	42	(81%)
6	(Improved) Planning	(50%)	26	-	26	(50%)	(31%)	16	-	36	(69%)
7	(Improved) Knowledge & Understanding	(54%)	28	-	24	(46%)	(21%)	11	-	41	(79%)
8	(Enhanced) Enterprise Integration & Consolidation	(15%)	8	-	44	(85%)	(38%)	20	-	32	(62%)
9	(Reduced) Complexity	(08%)	4	-	48	(92%)	(25%)	13	-	39	(75%)
10	(Increased) Flexibility	(06%)	3	-	49	(94%)	(17%)	9	-	43	(83%)
11	(Improved) Communication	(62%)	32	-	20	(38%)	(31%)	16	-	36	(69%)
12	(Improved) Interoperability	(08%)	4	-	48	(92%)	(37%)	19	-	33	(63%)
13	(Increased) Process Improvement & Standardization	(38%)	20	-	32	(62%)	(46%)	24	-	28	(54%)
14	(Increased) Reuse	(21%)	11	-	41	(79%)	(52%)	27	-	25	(48%)
15	(Improved) Portfolio Management	(40%)	21	-	31	(60%)	(40%)	21	-	31	(60%)
16	(Reduced) Costs	(13%)	7	-	45	(87%)	(65%)	34	-	18	(35%)
17	(Improved) Risk Management	(15%)	8	-	44	(85%)	(17%)	9	-	43	(83%)
18	(Improved) IT Integration	(23%)	12	-	40	(77%)	(31%)	16	-	36	(69%)
19	(Improved) Quality	(15%)	8	-	44	(85%)	(17%)	9	-	43	(83%)
20	(Fostered) Innovation	(08%)	4	-	48	(92%)	(10%)	5	-	47	(90%)
21	(Improved) Customer Orientation	(12%)	6	-	46	(88%)	(15%)	8	-	44	(85%)
22	(Improved) IT Delivery	(19%)	10	-	42	(81%)	(38%)	20	-	32	(62%)
23	(Improved) Time to Market	(08%)	4	-	48	(92%)	(40%)	21	-	31	(60%)
24	(Increased) Compliance	(19%)	10	-	42	(81%)	(33%)	17	-	35	(67%)
25	(Increased) Management Satisfaction	(19%)	10	-	42	(81%)	(38%)	20	-	32	(62%)
26	(Enhanced) Assurance	(12%)	6	-	46	(88%)	(17%)	9	-	43	(83%)
27	(Improved) Security Management	(04%)	2	-	50	(96%)	(17%)	9	-	43	(83%)
28	(Enhanced) Technological Evolvability	(08%)	4	-	48	(92%)	(10%)	5	-	47	(90%)
29	(Facilitated) Outsourcing	(21%)	11	-	41	(79%)	(21%)	11	-	41	(79%)

Our study was not without limitations. Unfortunately, one of the criteria established for evaluating the level of consensus, the level of agreement of opinion in the three rounds, did not obtain a satisfactory value as intended, which can be explained by the heterogeneity of the expert panel. However, as mentioned before, the level of stability achieved in the consolidated rankings and the

heterogeneity of the expert panel itself allows we to have a good confidence in the results.

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AUTHOR BIOGRAPHIES

LUIS SILVA RODRIGUES is currently a Ph.D student at the University of Minho and is a lecturer at the Instituto Superior de Contabilidade e Administração do Porto where he teaches courses on information systems and technology. He holds a M.Sc. in Informatics from the University of Minho, with specialization in Information Systems Architectures. He is the author of three books on Information Technology (in Portuguese) and has scientific papers presented and published at international conferences.

LUIS AMARAL holds a Ph.D. on Information Systems from University of Minho. He is an Associate Professor at the University of Minho where he teaches courses on information systems management to undergraduate and postgraduate degrees. He is also involved in several research projects in the area of methodologies for organizational intervention activities. He has supervised several master and doctoral dissertations, and is author of several scientific publications presented at international conferences and published in scientific and technical journals.

Universidade do Minho

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APPENDIX A: VALUE DRIVERS NAMES AND SHORT DEFINITIONS/DESCRIPTIONS

Value Drivers Initial List

(Increased) Agility: Refers to the ability of the organization to identify the changes in its environment and respond appropriately.
(Improved) Alignment: Refers to the fit between strategy and infrastructure and processes, the functional integration of business and IT, and the alignment with partners.
(Improved) Change Management: Refers to the processes by which an organization transforms from its present state to a desired future state, to adapt to an environment in constant development.
(Improved) Communication: Refers to the exchange of information, ideas, thoughts and emotions between the organization's stakeholders (individual or group).
(Reduced) Complexity: Refers to the diversity and intricateness associated with organizational structure, processes, activities, IT and other components of the organization.
(Increased) Compliance: Refers to the organization's conformity or obedience to regulations and legislation.
(Reduced) Costs: Refers to the expenses incurred in running a business.
(Improved) Customer Orientation: Refers to the long-term purpose to satisfy customer needs.
(Improved) Decision Making: Refers to the processes of sufficiently reducing uncertainty and doubt about alternatives to allow a reasonable choice to be made from among them.
(Increased) Flexibility: Refers to the ability of the organization to change organizational components without major changes and investment.
(Improved) Governance: Refers to the processes and structures relating to consistent management, cohesive policies, guidance, and decision rights for different areas of responsibilities.
(Fostered) Innovation: Refers to the embodiment, combination, or synthesis of knowledge in original, relevant, valued new products, processes, services or IT.
(Improved) Interoperability: Refers to the capability to communicate, execute programs, or transfer data among various functional units in a manner that requires the user to have little or no knowledge of the unique characteristics of those units.
(Improved) IT Delivery: Refers to the planning, development/acquisition and implementation of IT solutions.
(Improved) IT Integration: Refers to the integration of communication, data and application to enable consistent and real-time connectivity among function units.
(Improved) Knowledge & Understanding: Refers to knowledge (and its management) in an organization and to the understanding of how it is organized and operates.
(Increased) Management Satisfaction: Refers to the degree of confidence of all management levels in how the organizational components are organized and operate in order to achieve the objectives.
(Facilitated) Outsourcing: Refers to contracting, subcontracting or "externalizing" non-core activities and/or services to third parties.
(Improved) Planning: Refers to the processes of setting goals and objectives, developing strategies, and outlining tasks and schedules to accomplish those goals and objectives.
(Improved) Portfolio Management: Refers to the combination of tools and methods used to measure, control, and increase the return on both individual investments and on an aggregate enterprise level in a desirable manner that meets the organization's objectives.
(Increased) Process Improvement & Standardization: Refers to the combination of tools and methods used to measure, control, and increase the return on both individual investments and on an aggregate enterprise level in a desirable manner that meets the organization's objectives.
(Improved) Quality: Refers to the degree to which a set of inherent characteristics fulfills the requirements of a process, product, service or IT.
(Increased) Reuse: Refers to the ability of the organization to promote enterprise-wide thinking about resource utilization through reusing and/or reducing/avoiding duplication among business areas and other organizational components and resources.
(Improved) Risk Management: Refers to the identification, assessment, and prioritization of risks followed by a coordinated and economical application of resources in order to minimize, monitor, and control the probability and/or impact of certain events.
(Improved) Security Management: Refers to the development, implementation, guidance and monitoring of the organization's security strategy and activities.
(Improved) Time to Market: Refers to the identification, development, presentation and delivery of new or improved products or services to markets and customers.

Value Drivers Added after Round 1

(Enhanced) Assurance: Refers to the ability of the organization to establish and institutionalize (internalize) practices that ensure fulfillment of organizational goals and achievement of outcomes.
(Enhanced) Enterprise Integration & Consolidation: Refers to the fit between strategy and infrastructure and processes, the functional integration of business and IT, and the alignment with partners.
(Enhanced) Technological Evolvability: Refers to the ability of the organization to evolve its baseline systems with new (state of the art) technologies.